Listing of Claims

1. (Previously Presented) A method for allocating code pairs of orthogonal spreading codes having guard bits of 0, comprising:

generating at least one orthogonal code set based upon the orthogonal spreading codes;

determining one of the at least one orthogonal code set as a representative orthogonal code set; and

allocating an order of code pairs according to a prescribed rule based upon the representative orthogonal code set.

2. (Previously Presented) The method according to claim 1, further comprising matching the orthogonal spreading codes to at least one element included in the representative orthogonal code set in an ascending order if the representative orthogonal code set is determined.

3. (Previously Presented) The method according to claim 1, wherein said step of generating the orthogonal code set comprises:

generating the orthogonal spreading codes corresponding to a selected code length;

adjusting the interval of an Interference Free Window (IFW) length based upon a selected code component length; and

generating the at least one orthogonal code set and at least one element included in each of the at least one orthogonal code set until a prescribed condition is satisfied.

4. (Previously Presented) The method according to claim 3, wherein the prescribed condition comprises $2^{g-1} \leq L_{IIFW} \leq 2^{g}$.

5. (Previously Presented) The method according to claim 3, wherein the at least one orthogonal code set is calculated using:

$$O_K = \{LS^{N+2\times L_{GUARD}}_{(K-1)\times 2^{m-g}}, LS^{N+2\times L_{GUARD}}_{(K-1)\times 2^{m-g}+1}, \ldots, LS^{N+2\times L_{GUARD}}_{(K-1)\times 2^{m-g}+2^{m-g}-1}\},$$

wherein O_k is the kth orthogonal code set, and $LS^{N+2\times L_{GUARD}}_{(k-1)\times 2^{m-g}+j}$ is the jth orthogonal spreading code of the kth orthogonal code set.

6. (Previously Presented) The method according to claim 1, further comprising:

determining whether to differently allocate the orthogonal spreading codes corresponding to the at least one element of the representative code set to an I branch and a Q branch; and

determining whether to allocate code pairs which minimize a peak-to-average power ratio if differently allocated.

7. (Previously Presented) The method according to claim 6, further comprising:

generating at least one code set using the representative code set if the orthogonal spreading codes are not differently allocated to the I branch and the Q branch;

selecting the at least one code set in a prescribed order; and

allocating the order of the codes according to a prescribed rule based upon at least one element of the selected code set.

8. (Previously Presented) The method according to claim 7, wherein the at least one code set is calculated using:

$$L_k=\{l_{2^k},l_{2^k+1},l_{2^k+2},\cdots,l_{2^{k+1}-2},l_{2^{k+1}-1}\},$$

wherein L_k is the kth code set, and l is an element included in the code set.

9. (Previously Presented) The method according to claim 6, further comprising:

generating at least one code pair based upon the representative code set if the code pair is allocated to minimize the peak-to-average power ratio;

generating a code pair set based upon the at least one code pair; and

allocating the code order based upon the at least one code pair included in the code pair set.

10. (Previously Presented) The method according to claim 9, wherein the code pair is generated on the basis of a center of the at least one element of the representative code set, and wherein the at least one element is arrayed in the ascending order.

11. (Previously Presented) The method according to claim 6, further comprising:

grouping at least one code pair set according to a prescribed rule based upon the representative code set if the code pair which minimizes the peak-to-average power ratio is not allocated;

selecting a code pair set from the at least one code pair set according to the determined order;

generating at least one code pair on the basis of the center of the at least one element included in the selected code pair set; and

allocating the code order based upon the at least one code pair.

12. (Currently Amended) A method for generating an orthogonal code set using orthogonal spreading codes, comprising:

generating orthogonal spreading codes corresponding to a prescribed code length;

adjusting an interval of a length of an interference free window (IFW) based upon a prescribed code component length; and

generating at least one orthogonal code set based upon the orthogonal spreading code if the length of the IFW interval is adjusted.

13. (Previously Presented) The method according to claim 12, wherein the at least one orthogonal code set is generated until a prescribed condition is satisfied.

14. (Currently Amended) A method for allocating code pairs using orthogonal spreading codes, comprising:

determining one of at least one orthogonal code set as a representative orthogonal code set;

allocating different orthogonal spreading codes to an I branch and a Q branch, and determining whether to minimize a peak-to-average power ratio;

generating at least one code pair based upon the representative orthogonal code set according to whether the code pair for minimizing a peak-to-average power ratio is allocated;

generating a code pair set based upon the at least one code pair; and

allocating a code order based upon the at least one code pair included in the code pair set, wherein the code pair is generated on the basis of a center of at least one element of the representative orthogonal code set, wherein the at least one element is arrayed in an ascending order.

15. (Canceled)

16. (Currently Amended) A method for allocating code pairs using orthogonal spreading codes, comprising:

determining one of at least one orthogonal code set as a representative orthogonal code set;

allocating different orthogonal spreading codes to an I branch and a Q branch, and determining whether to minimize a peak-to-average power ratio;

grouping at least one code pair set according to a prescribed rule based upon the representative orthogonal code set in accordance with whether the code pair for minimizing a peak-to-average power ratio is allocated;

selecting a code pair set from the at least one code pair according to a prescribed order;

generating at least one code pair based on <u>a center of at least one element of the representative orthogonal code set and</u> at least one element included in the selected code pair set; and

allocating a code order based upon the at least one code pair.

17. (Currently Amended) A method for allocating code pairs using orthogonal spreading codes, comprising:

determining one orthogonal set of at least one orthogonal code set as a representative orthogonal code set;

determining whether to identically allocate the same orthogonal spreading code to an I branch and a Q branch;

generating at least one code set by using the orthogonal code set according to whether different orthogonal spreading codes are to be allocated to an I component and a Q component;

selecting the at least one code set in a prescribed order; and

allocating a code order according to a prescribed rule based upon at least one element of the selected code set<u>, wherein the at least one element is arrayed in an ascending order</u>.

18. (Previously Presented) The method of claim 1, wherein allocating the order of code pairs comprises:

arraying the elements of the orthogonal code set in an ascending order, wherein the ascending order comprises a first element, a center element, an element before center and a last element;

pairing the first element with the center element; and

pairing the element before center with the last element.

19. (Previously Presented) The method of claim 1, wherein allocating the order of code pairs comprises allocating code pairs in accordance with:

$$P = \{(I_0, I_{2^{m-g-1}}), (I_1, I_{2^{m-g-1}+1}), \cdots, (I_{2^{m-g-1}-1}, I_{2^{m-g}-1})$$

wherein "I" is an orthogonal code from the orthogonal code set, "g" is a natural number, and "m" is a natural number greater than 2.

20. (Previously Presented) The method of claim 1, wherein allocating the order of code pairs comprises:

arraying the elements of the orthogonal code set in an ascending order, wherein the ascending order comprises a first half of elements with a first element, a quarter-center element in the center of the first half of elements, and a last element;

pairing the first element with the first element from the quarter-center element; and

pairing the element before the quarter-center with the last element.

21. (Previously Presented) The method of claim 1, wherein allocating the order of code pairs comprises allocating code pairs in accordance with:

$$L_{m-g-1} = \{l_{2^{m-g-1}}, l_{2^{m-g-1}+1}, l_{2^{m-g-1}+2}, \cdots, l_{2^{m-g}-2}, l_{2^{m-g}-1}\}$$

wherein a representative orthogonal code set is expressed as:

$$L = \{l_0, l_1, \cdots, l_{2^{m-g}-2}, l_{2^{m-g}-1}\}$$

22. (Previously Presented) A method to generate orthogonal code sets, comprising:

selecting a code length N equal to or larger than 4;

determining whether the selected code length N equals 2^m, where m is equal to or larger than 2;

generating an orthogonal spreading code if N equals 2^m;

selecting a code component length L_{GUARD} and an IFW length L_{IFW};

determining whether $L_{GUARD} \geq L_{IFW} \geq 0$ is true;

selecting a new L_{GUARD} and L_{IFW} until $L_{GUARD} \geq L_{IFW} \geq 0$ is true;

calculating g based on $2^{g-1} \leq L_{IFW} \leq 2^g$ if $L_{GUARD} \geq L_{IFW} \geq 0$;

setting k equal to 1, and j equal to 0;

repeat adding the $(k-1)2^{m-g}+j$ orthogonal spreading code to the k^{th} orthogonal code set and adding 1 to j until $j > 2^{m-g}-1$ is true;

adding 1 to k if $j > 2^{m-g}-1$ is true;

if $k > 2^g$ is not true, repeat adding the $(k-1)2^{m-g}+j$ orthogonal spreading code to the k^{th} orthogonal code set and adding 1 to k until $k > 2^g$ is true; and

selecting one orthogonal code set from the generated orthogonal code sets as the representative orthogonal code set if $k > 2^g$ is true.

23. (Previously Presented) A method of allocating code pairs using a representative orthogonal code set, comprising:

determining whether orthogonal spreading codes are to be differently allocated to an I branch and a Q branch or to be similarly allocated to the I branch and the Q branch;

if orthogonal spreading codes are to be differently allocated, determining whether code pairs to minimize peak-to-average power ratio are to be allocated;

if orthogonal spreading codes are to be differently allocated to an I branch and a Q branch, and are to be allocated to minimize peak-to-average power ratio, allocate orthogonal spreading codes by:

arraying the elements of the orthogonal code set in an ascending order, wherein the ascending order comprises a first element, a center element, an element before center and a last element,

pairing the first element with the center element, and

pairing the element before center with the last element;

if orthogonal spreading codes are to be differently allocated to an I branch and a Q branch and are not to be allocated to minimize peak-to-average power ratio, allocate orthogonal spreading codes by:

arraying the elements of the orthogonal code set in an ascending order, wherein the ascending order comprises a first half of elements with a first element, a quarter-center element in the center of the first half of elements, and a last element,

pairing the first element with the first element from the quarter-center element, and

pairing the element before the quarter-center with the last element;

if the orthogonal spreading codes are to be similarly allocated to the I branch and the Q branch allocate orthogonal spreading codes by allocating code pairs in accordance with:

$$L = \{l_0, l_1, \cdots, l_{2^{m-g}-2}, l_{2^{m-g}-1}\}$$

wherein a representative orthogonal code set is expressed as:

$$P = \{(l_0, l_{2^{m-g-1}}), (l_1, l_{2^{m-g-1}+1}), \cdots, (l_{2^{m-g-1}-1}, l_{2^{m-g}-1})$$

24. (Previously Presented) The method of claim 23, wherein if orthogonal spreading codes are to be differently allocated to an I branch and a Q branch and are to be allocated to minimize peak-to-average power ratio, allocating code pairs in accordance with:

$$L_{m-g-1} = \{l_{2^{m-g-1}}, l_{2^{m-g-1}+1}, l_{2^{m-g-1}+2}, \cdots, l_{2^{m-g}-2}, l_{2^{m-g}-1}\}$$

wherein "l" is an orthogonal code from the orthogonal code set, "g" is a natural number, and "m" is a natural number greater than 2.

25. (Previously Presented) An apparatus for generating orthogonal spreading codes, comprising:

a processor coupled to a memory, wherein the processor and the memory are configured to:

select a code length N equal to or larger than 4;

determine whether the selected code length N equals 2^m, where m is equal to or larger than 2;

generate an orthogonal spreading code if N equals 2^m;

select a code component length L_{GUARD} and an IFW length L_{IFW};

determine whether $L_{GUARD} \geq L_{IFW} \geq 0$ is true;

select a new L_{GUARD} and L_{IFW} until $L_{GUARD} \geq L_{IFW} \geq 0$ is true;

calculate g based on $2^{g-1} \leq L_{IFW} \leq 2^g$ if $L_{GUARD} \geq L_{IFW} \geq 0$;

set k equal to 1, and j equal to 0;

repeat adding the $(k-1)2^{m-g}+j$ orthogonal spreading code to the k^{th} orthogonal code set and adding 1 to j until $j > 2^{m-g}-1$ is true;

add 1 to k if $j > 2^{m-g}-1$ is true;

if $k > 2^g$ is not true, repeat adding the $(k-1)2^{m-g}+j$ orthogonal spreading code to the k^{th} orthogonal code set and add 1 to k until $k > 2^g$ is true; and

select one orthogonal code set from the generated orthogonal code sets as the representative orthogonal code set if $k > 2^g$ is true.

26. (Previously Presented) An apparatus for allocating orthogonal spreading codes using a representative orthogonal code set, comprising:

a processor coupled to a memory, wherein the processor and the memory are configured to:

determine whether orthogonal spreading codes are to be differently allocated to an I branch and a Q branch or to be similarly allocated to the I branch and the Q branch;

if orthogonal spreading codes are to be differently allocated, determine whether code pairs to minimize peak-to-average power ratio are to be allocated;

if orthogonal spreading codes are to be differently allocated to an I branch and a Q branch, and are to be allocated to minimize peak-to-average power ratio:

array the elements of the orthogonal code set in an ascending order, wherein the ascending order comprises a first element, a center element, an element before center and a last element,

pair the first element with the center element, and

pair the element before center with the last element;

if orthogonal spreading codes are to be differently allocated to an I branch and a Q branch and are not to be allocated to minimize peak-to-average power ratio:

array the elements of the orthogonal code set in an ascending order, wherein the ascending order comprises a first half of elements with a first element, a quarter-center element in the center of the first half of elements, and a last element,

pair the first element with the first element from the quarter-center element, and

pair the element before the quarter-center with the last element;

if the orthogonal spreading codes are to be similarly allocated to the I branch and the Q branch, allocate orthogonal spreading codes in accordance with:

$$L = \{l_0, l_1, \cdots, l_{2^{m-g}-2}, l_{2^{m-g}-1}\}$$

wherein a representative orthogonal code set is expressed as:

$$L_{m-g-1} = \{l_{2^{m-g-1}}, l_{2^{m-g-1}+1}, l_{2^{m-g-1}+2}, \cdots, l_{2^{m-g}-2}, l_{2^{m-g}-1}\}$$